

Clear Zones

Design Manual
Chapter 1
General Information

Originally Issued: 07-12-96

Revised: 06-18-04

This section provides guidelines for determining clear zones on primary highways. A highway's clear zone is the total roadside border area available for safe use by errant vehicles.¹ Within the clear zone, all slopes should be no steeper than 3:1 and free of objects that would interfere with a motorist's ability to regain control of an errant vehicle. The desired width of the clear zone depends on traffic volumes, speeds, and roadside geometry. The location from which the clear zone is measured ("edge of traveled way" or "back of curb") and the appropriate procedure for determining the clear zone depend on the type of highway.

Rural, Transitional and Other High-Speed Roadways

For freeways, expressways, super-two highways, rural two-lane highways, and transitional facilities, the designer should use Table 1 to determine the appropriate clear zone. Refer to page 4 for clear zone distances for temporary traffic control zones. The clear zone for high-speed roadways is measured from the edge of traveled way, exclusive of auxiliary lanes such as climbing lanes, turning lanes, or partially-paved shoulders.

Table 1 gives a range of allowable clear zone widths. The lower value in this range should be considered the minimum clear zone width, while the higher value should be considered the desirable width. In application, features that are made significantly more costly by a wider clear zone (for example, box culverts) should generally be designed to provide at least the minimum clear zone width. On the other hand, features whose costs are not affected in a major way by the clear zone width (i.e., new trees or utility poles) should be located outside the desirable clear zone, or even further from the roadway if the available right-of-way permits. Any evaluations of existing features should be based on the minimum clear zone width.

¹ AASHTO *Roadside Design Guide* (Washington D.C., 2002), p. G-1.

Table 1: Clear zone distances (in feet from edge of traveled way)².

design speed	design ADT	fill slope (fs)			cut slope (cs)		
		fs ≥ 6:1	4:1 ≤ fs < 6:1	fs < 4:1	cs < 4:1	4:1 ≤ cs < 6:1	cs ≥ 6:1
40 mph or less	ADT < 750	7–10	7–10	—**	7–10	7–10	7–10
	750 ≤ ADT < 1500	10–12	12–14	—**	10–12	10–12	10–12
	1500 ≤ ADT < 6000	12–14	14–16	—**	12–14	12–14	12–14
	ADT ≥ 6000	14–16	16–18	—**	14–16	14–16	14–16
45 – 50 mph	ADT < 750	10–12	12–14	—**	8–10	8–10	10–12
	750 ≤ ADT < 1500	14–16	16–20	—**	10–12	12–14	14–16
	1500 ≤ ADT < 6000	16–18	20–26	—**	12–14	14–16	16–18
	ADT ≥ 6000	20–22	24–28	—**	14–16	18–20	20–22
55 mph	ADT < 750	12–14	14–18	—**	8–10	10–12	10–12
	750 ≤ ADT < 1500	16–18	20–24	—**	10–12	14–16	16–18
	1500 ≤ ADT < 6000	20–22	24–30	—**	14–16	16–18	20–22
	ADT ≥ 6000	22–24	26–32*	—**	16–18	20–22	22–24
60 mph	ADT < 750	16–18	20–24	—**	10–12	12–14	14–16
	750 ≤ ADT < 1500	20–24	26–32*	—**	12–14	16–18	20–22
	1500 ≤ ADT < 6000	26–30	32–40*	—**	14–18	18–22	24–26
	ADT ≥ 6000	30–32*	36–44*	—**	20–22	24–26	26–28
65 – 70 mph	ADT < 750	18–20	20–26	—**	10–12	14–16	14–16
	750 ≤ ADT < 1500	24–26	28–36*	—**	12–16	18–20	20–22
	1500 ≤ ADT < 6000	28–32*	34–42*	—**	16–20	22–24	26–28
	ADT ≥ 6000	30–34*	38–46*	—**	22–24	26–30	28–30

*Where a site specific investigation indicates a high probability of continuing accidents, or such occurrences are indicated by accident history, the designer may provide clear zone distances greater than 30 feet as indicated. Clear zones may be limited to 30 feet for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

**Since recovery is less likely on the unshielded, traversable 3:1 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories. Also, the distance between the edge of the travel lane and the beginning of the 3:1 slope should influence the recovery area provided at the toe of slope.

Table 1 (continued): Clear zone distances (in meters from edge of traveled way).²

design speed	design ADT	fill slope (fs)			cut slope (cs)		
		fs ≥ 6:1	4:1 ≤ fs < 6:1	fs < 4:1	cs < 4:1	4:1 ≤ cs < 6:1	cs ≥ 6:1
60 km/h or less	ADT < 750	2.0–3.0	2.0–3.0	—**	2.0–3.0	2.0–3.0	2.0–3.0
	750 ≤ ADT < 1500	3.0–3.5	3.5–4.5	—**	3.0–3.5	3.0–3.5	3.0–3.5
	1500 ≤ ADT < 6000	3.5–4.5	4.5–5.0	—**	3.5–4.5	3.5–4.5	3.5–4.5
	ADT ≥ 6000	4.5–5.0	5.0–5.5	—**	4.5–5.0	4.5–5.0	4.5–5.0
70 – 80 km/h	ADT < 750	3.0–3.5	3.5–4.5	—**	2.5–3.0	2.5–3.0	3.0–3.5
	750 ≤ ADT < 1500	4.5–5.0	5.0–6.0	—**	3.0–3.5	3.5–4.5	4.5–5.0
	1500 ≤ ADT < 6000	5.0–5.5	6.0–8.0	—**	3.5–4.5	4.5–5.0	5.0–5.5
	ADT ≥ 6000	6.0–6.5	7.5–8.5	—**	4.5–5.0	5.5–6.0	6.0–6.5
90 km/h	ADT < 750	3.5–4.5	4.5–5.5	—**	2.5–3.0	3.0–3.5	3.0–3.5
	750 ≤ ADT < 1500	5.0–5.5	6.0–7.5	—**	3.0–3.5	4.5–5.0	5.0–5.5
	1500 ≤ ADT < 6000	6.0–6.5	7.5–9.0	—**	4.5–5.0	5.0–5.5	6.0–6.5
	ADT ≥ 6000	6.5–7.5	8.0–10.0*	—**	5.0–5.5	6.0–6.5	6.5–7.5
100 km/h	ADT < 750	5.0–5.5	6.0–7.5	—**	3.0–3.5	3.5–4.5	4.5–5.0
	750 ≤ ADT < 1500	6.0–7.5	8.0–10.0*	—**	3.5–4.5	5.0–5.5	6.0–6.5
	1500 ≤ ADT < 6000	8.0–9.0	10.0–12.0*	—**	4.5–5.5	5.5–6.5	7.5–8.0
	ADT ≥ 6000	9.0–10.0*	11.0–13.5*	—**	6.0–6.5	7.5–8.0	8.0–8.5
110 km/h	ADT < 750	5.5–6.0	6.0–8.0	—**	3.0–3.5	4.5–5.0	4.5–4.9
	750 ≤ ADT < 1500	7.5–8.0	8.5–11.0*	—**	3.5–5.0	5.5–6.0	6.0–6.5
	1500 ≤ ADT < 6000	8.5–10.0*	10.5–13.0*	—**	5.0–6.0	6.5–7.5	8.0–8.5
	ADT ≥ 6000	9.0–10.5*	11.5–14.0*	—**	6.5–7.5	8.0–9.0	8.5–9.0

*Where a site specific investigation indicates a high probability of continuing accidents, or such occurrences are indicated by accident history, the designer may provide clear zone distances greater than 9 meters as indicated. Clear zones may be limited to 9 meters for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

**Since recovery is less likely on the unshielded, traversable 3:1 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories. Also, the distance between the edge of the travel lane and the beginning of the 3:1 slope should influence the recovery area provided at the toe of slope.

Adjustments for horizontal curves should be applied at selected locations. The clear zone should be considered for widening at curves, using Table 2, when an accident history suggests the need for additional clear zone width or when all of the following criteria are met:

- the radius of the curve is less than 2860 feet (900 meters)
- the curve occurs on a high-speed roadway (design speed of 55 mph (90 km/hr) or greater)
- the curve occurs on a normally tangent alignment (one where the curve is preceded by a tangent more than a mile (kilometer) in length).

Use the following equation to determine the clear zone distance when widening at horizontal curves:

$$CZ_c = (L_c)(K_{cz})$$

² AASHTO *Roadside Design Guide* (Washington, D.C., 2002), p. 3-5 & 6.

where:

CZ_c = clear zone on outside of curvature, in feet (meters)

L_c = clear zone distance, in feet (meters) (from Table 1)

K_{cz} = curve correction factor (from Table 2)

Table 2: Horizontal curve adjustments.

K_{cz} (English curve correction factor)

radius (ft.)	design speed (mph)						
	40	45	50	55	60	65	70
2860	1.1	1.1	1.1	1.2	1.2	1.2	1.3
2290	1.1	1.12	1.2	1.2	1.2	1.3	1.3
1910	1.1	1.2	1.2	1.2	1.3	1.3	1.4
1640	1.1	1.2	1.2	1.3	1.3	1.4	1.5
1430	1.2	1.2	1.3	1.3	1.4	1.4	
1270	1.2	1.2	1.3	1.3	1.4	1.5	
1150	1.2	1.2	1.3	1.4	1.5		
950	1.2	1.3	1.4	1.5	1.5		
820	1.3	1.3	1.4	1.5			
720	1.3	1.4	1.5				
640	1.3	1.4	1.5				
570	1.4	1.5					
380	1.5						

K_{cz} (metric curve correction factor)

radius (m)	design speed (km/h)					
	60	70	80	90	100	110
900	1.1	1.1	1.1	1.2	1.2	1.2
700	1.1	1.1	1.2	1.2	1.2	1.3
600	1.1	1.2	1.2	1.2	1.3	1.4
500	1.1	1.2	1.2	1.3	1.3	1.4
450	1.2	1.2	1.3	1.3	1.4	1.5
400	1.2	1.2	1.3	1.3	1.4	
350	1.2	1.2	1.3	1.4	1.5	
300	1.2	1.3	1.4	1.5	1.5	
250	1.3	1.3	1.4	1.5		
200	1.3	1.4	1.5			
150	1.4	1.5				
100	1.5					

As Figure 1 shows, the clear zone should be adjusted only on the outside of the first curve following the tangent. If the alignment is generally curvilinear, no adjustment factor should be applied. Similarly, if the alignment is curvilinear preceding the curve in question, then no adjustment factor should be applied. Generally, the added clear zone width called for by the horizontal curve adjustment factor should be thought of as a desirable clear zone rather than a minimum. If the minimum width called for by Table 1 can be achieved, but the added width cannot be, a barrier would not normally be needed. The horizontal curve adjustment factor should be applied to projects where grading is a significant part of the project and available right-of-way allows for a wider clear zone.

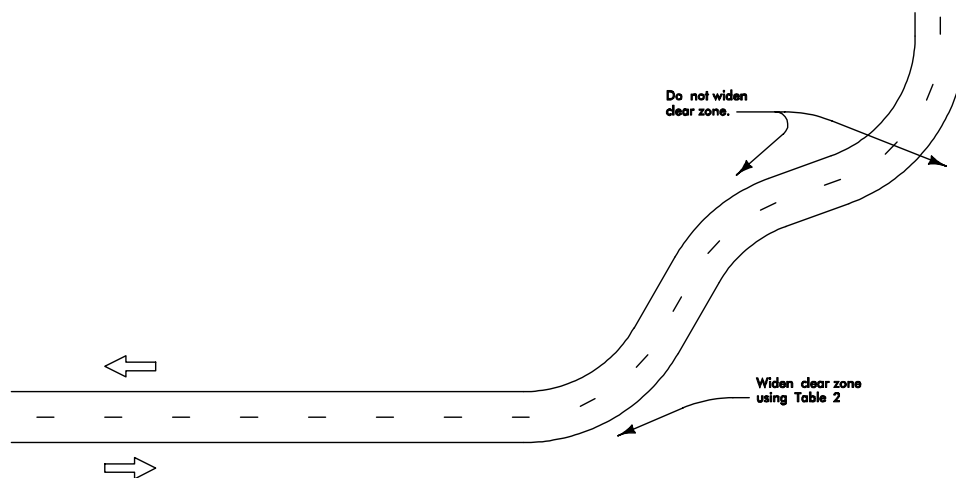


Figure 1: Clear zone adjustment at horizontal curves.

Reduced-Speed Urban Facilities

For reduced-speed urban roadways (those with urban cross sections and expected regulatory speeds of 35 mph (65 km/h) or less) the clear zone should be 10 feet (3 meters) normal and 12 feet (3.6 meters) desirable, measured from the back of the curb. The Department normally purchases right-of-way 12 feet (3.6 meters) back of the curb in urban areas to provide for the desirable clear zone width. Where no reasonable alternative exists, aboveground utilities may be accommodated in the outermost 2-foot (0.6-meter) width of the right-of-way. On projects where safety is the principal goal, the clear zone may be designed to higher standards. Design exceptions may be justified on a case specific basis.

When the primary road extension has an expected regulatory speed limit of 25 mph (40 km/h) or less, while the desirable clear zone remains the same, the minimum may be reduced to 6 feet (1.8 meters) measured from the back of curb.

If a turning lane, auxiliary lane, or paved shoulder results in a curb outside the normal roadway width, then a minimum 4-foot (1.2-meter) clear zone measured from the back of this curb should be provided.

If on-street parking is allowed on the primary highway, normal clear zone provisions cannot be met. A minimum operational clearance of 2 feet (0.6 meters) between the traffic and the parked vehicles needs to be provided within the roadway cross section. In this case, any objects, such as luminaire or sign supports, should be constructed no closer than 1.5 feet (0.5 meters) from the back of the curb.

Preferably, all objects should be placed outside of the minimum clear zone. If this placement is not practical, objects proven to be “breakaway”, such as certain sign supports, may be constructed or allowed to remain in place within the clear zone. Objects broken away in a crash could possibly injure pedestrians; breakaway objects may not be recommended for locations between the curb and sidewalk if high volumes of pedestrian traffic are expected. In all cases, the near edge of any object should be no closer than 1.5 feet (0.5 meters) to the back of the curb to allow for a minimum operational clearance.

The above provisions apply only to urban primary highway extensions. When portions of side streets under the city's jurisdiction are reconstructed as part of a project on a primary highway, recommended practices in the Department's *Urban Design Aids* and *Alternate Urban Design Guide*, available from the Office of Local Systems, should be followed. The Department retains the right to ensure that adequate sight distance is provided at any intersections or accesses.

Clear Zone Distances for Temporary Traffic Control Zones

Clear zones for temporary traffic control zones must be approached from a unique perspective. Unlike permanent situations where the life of a project is anywhere from 20 to 50 years, the life of a temporary traffic control zone is measured in weeks or months. If this relatively short life span is used to calculate a ratio of benefits versus cost, the analysis usually favors an unshielded option. Therefore, field performance is used to determine a reasonable clear zone distance.

An effort should be made to provide as much clear recovery area as possible without undo cost or interference. However, in situations where ideal clear zone distances are not possible or are impractical, the Department has adopted the following minimum requirements regarding clear zone determination in temporary traffic control zones:

- On two-lane rural roadways with alternating one-way traffic controlled by signals or flaggers, the minimum clear zone distance shall be the outside edge of the shoulder or 10 feet (3 meters), whichever is less.
- On two-lane rural roadways where both lanes of traffic remain open, the clear zone shall be 10 feet (3 meters).
- On non-interstate four-lane divided roadways the minimum clear zone shall be the greater of 10 feet (3 meters) or the outside edge of the shoulder.
- For interstate roadways the minimum clear zone distance shall be 15 feet (4.6 meters) or the outside edge of the shoulder, whichever is greater. For more information, see Section 9B-9.

Vertical Clear Zones

The horizontal clear zones described above should extend vertically a sufficient distance to effectively eliminate obstacles. Where feasible, the clear zone should extend vertically at least 14 feet 6 inches (4.5 meters). If this is not possible, a benefit/cost analysis may be necessary to determine if shielding or other treatment is warranted.

Keep in mind the difference between vertical clearance and the vertical clear zone. The values for vertical clearance that are provided in Section 1C-1, should be maintained above all lanes and shoulders. The vertical clear zone referred to above should be maintained throughout the entire horizontal clear zone.

Applying Clear Zone Guidelines

From a safety standpoint, it is always preferable to remove objects from the roadside. Where removing an object is not feasible, there are other options, listed below in order of preference:

- Relocate the object to a point where it is less likely to be hit.
- Reduce impact severity by using an appropriate breakaway device.
- Shield the object with a longitudinal traffic barrier and/or crash cushion if it cannot be eliminated, relocated, or redesigned.
- Delineate the object if the above alternatives are not appropriate.

Relocated objects should be placed outside the recommended clear zone, preferably near the right-of-way line. Each additional foot that an object is offset from the roadway provides an incremental safety benefit to drivers. However, the next foot out from a given offset provides less benefit than the previous one provided. If a significantly greater offset from the roadway can't be achieved, other options may be considered.

Some objects may be redesigned so that they will readily break away when struck by a vehicle. When other alternatives are not feasible, then the object may need to be shielded with a longitudinal barrier. Chapter 8 of this manual covers the design of these barriers.

The guidelines given above are intended to be applied with some limited flexibility. Examples of this flexibility can be found on urban roadways where buildings are close to the road. In cases where providing the minimum clear zone would require the purchase of a business or home, a design exception could be considered to avoid that purchase. Utility accommodations above ground may be precluded at these locations. Any exceptions to the provisions of this policy shall be approved by the Design Engineer.

The pictures on page 8 demonstrate good practice related to clear zone issues. For this project in Des Moines, utility poles and other obstacles were relocated outside the clear zone, greatly improving safety and the appearance of the area.



Before



After